

stroy the surface of *Casuarina* and you render the stem smooth—destroy the surface of *Equisetum* and you only increase the coarseness and strength of the sulcation. I may also add (in accordance with this view) that age or size has no connexion with this lincation of the surface, as is suggested by M. Brongniart in the last few lines of the quotation from his work at the head of this subject, for I find some of the largest stems perfectly smooth and the smallest occasionally striated. The sheaths are rather coarsely striated, and terminate in thin, flattened leaves, the midrib of which is scarcely discernible. In the weeping or downward curved branches the leaves are completely reflexed so as to point upwards, and according to the position of the stem, are either reflexed, expanded, or lying straight up against the stem. The stems vary from 3 to 7 lines in diameter.

Common in the white soft shale of Mulubimba, N. S. Wales.

Phyllothea Hookeri (M'Coy). Pl. XI. figs. 4, 5, 6, 7.

Sp. Char. Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose, subinfunduliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong, prominent midrib.

This species is easily known from the two former by its great loose sac-like sheath, completely concealing the stem (see Pl. XI. figs. 4 & 5), its long, thick, strongly ribbed leaves (see Pl. XI. fig. 6), and by its stem when stripped of its sheath being coarsely and regularly sulcated, precisely as in the *Calamites Cistii* (see Pl. XI. fig. 7). Although abundant, I have never seen a trace of a branch. Some of the flattened stems attain a width of two inches.

Common in the sandstone of Clark's Hill, in the siliceous schists of Arowa, and in the shales at Mulubimba, N. S. Wales.

[To be continued.]

XVI.—*Note on the Teredo norvegica* (T. *navalis*, *Turton*, not *Linn.*), *Xylophaga dorsalis*, *Limnoria terebrans* and *Chelura terebrans*, combined in destroying the submerged wood-work at the harbour of *Ardrossan* on the coast of *Ayrshire*. By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast*.

IN the Edinburgh 'Philosophical Journal' for January 1835, I published a memoir entitled, "On the *Teredo navalis* and *Lim-*

* Read at the Meeting of the British Association at Oxford in June last.

noris terebrans as at present existing on certain parts of the coasts of the British Islands." The chief localities commented on, were Portpatrick, on the coast of Scotland, and Donaghadee on that of Ireland, in both of which places, floating timber as well as the wood-work of the piers was destroyed to a most serious extent, the *Limnoria* being by far the more destructive of the two species. The *Teredo* was in that communication further mentioned as having attacked the wood-work of a sluice at Youghal, on the coast of Cork, and as having committed great havoc at the harbour of Dunmore, on the coast of Waterford—at the former locality the *Limnoria* was also met with. This species alone—without the addition of the *Teredo*—was noticed as destroying in 1834 the jetty at Kingstown harbour, in Dublin bay.

I am not aware of the two destructive agents—Molluscan and Crustacean—being commented on as conjoined in their evil labours, previous to the publication of that paper; nor do I remember having seen any notice of three species of these borers—and certainly not of four—having been at work in any one locality*.

Early in the month of May last, Major Martin of Ardrossan, in Ayrshire—a gentleman well-known as a lover of natural history, and as a successful collector of objects of zoological and botanical interest—sent me a piece of wood bored by the *Xylophaga dorsalis*, and labelled as from the dock-gates, Ardrossan. Not having before heard of this animal attacking the *fixed* timber of our harbours—it has been found in drift wood or portions of vessels cast ashore—I made immediate inquiry respecting it, suggesting at the same time that the *Teredo* should be looked for, and also, that the outside of the timber should be examined for very minute borings:—if such were observed, I requested to be informed whether they were of more than one size. Specimens of wood excavated by the *Limnoria* and *Chelura* were forwarded by post for my friend's guidance.

I shall here give his replies to queries on the subject generally.

The piece of wood sent was a portion of the dock-gates. The *Xylophaga* has been known to be consuming them since the docks were opened in March 1844. It has been known for a very considerable time along this coast, where there is no fresh water†. It attacks timber of all kinds: for instance, the wooden pier (the supporters of which are nearly destroyed) and other timbers that are under water about the quays, and have been

* Philippi, writing in 1839, mentions the *Teredo navalis*, Linn., being in the same timber with the *Chelura* at Trieste.

† It is perhaps twelve years since specimens from that locality were sent to me, but I imagined that they had been found in drift timber.

placed there without any preservative coating. It appears to prefer black birch to any other timber, but does not like African or American oak. The only successful preventive made use of for preserving the dock-gates against the *Teredo*, *Xylophaga*, &c. is Muntz's patent yellow metal sheathing, which is put on to the height of thirteen feet; it lasts for ten or twelve years. The timber that is perforated is always covered by water. The depth of water in the docks is from sixteen to eighteen feet. Red pine is the favourite timber of the Crustaceans.

On inspecting the pier, Major Martin could not observe that the *Xylophaga* had committed any destruction, but saw that the *Teredo* had been at work in some places. He cut off a piece of the wood from the outside and sent it to me. It contained in addition to the furrows of the *Teredo*, living specimens of both *Limnoria* and *Chelura*. This pier has been about eight years erected. I was also sent a portion of one of the dock-gates, consisting of a piece of pine two inches in thickness, and within the space of a few square inches containing the excavations of the whole four species. It may give some idea of the frequency of the *Xylophaga*'s perforations in the different pieces of wood, to mention, that on an average at least one-half is occupied by its burrows. The *Xylophaga* has never, like the *Teredo*, been observed by my correspondent to form a testaceous tube or lining to its cell.

Xylophaga dorsalis,

Turton seems to have been the first to notice, and under the name of *Teredo dorsalis* it appears in his 'Conchological Dictionary,' p. 185, and in his 'British Bivalves,' p. 16; but in the 'Addenda,' p. 253, to the latter work, he constituted the genus *Xylophaga* for its reception. His first specimens are noticed as "from a piece of wood in Torbay." He subsequently obtained "magnificent specimens of the *Teredo navalis* and this shell in their most perfect state" from "fragments of a wreck known to have been buried in the ocean for nearly half a century, near Berry Head, at the entrance of Torbay." This author remarks, that "like the *Teredo*, it inhabits the interior of the wood which has been some time under salt water, penetrating to the depth of from half an inch to an inch, forming for itself an oval receptacle or cavity, and having a very small and single external orifice," p. 254. He observes, that "its habitation in wood naturally separates it from the *Pholas*." But in this remark he forgot that at p. 11 of the same work he had noticed *Pholas striatus* as "taken from an old yard-arm on Brixham pier, and which had been drifted in from the bay." Very little would seem to be known of the *Xylophaga*. Deshayes, in the second edition of

Lamarck, t. vi. p. 47 (1835), quotes only Turton and Sowerby's 'Genera of Shells' (no. 29. tab. 101):—he calls it *Pholas xylophaga*. Broderip too in the 'Penny Cyclopædia' brings it under the genus *Pholas*, figures it in the wood, and also represents the valves separately and joined. It is there noticed as "found in cylindrical cavities eaten? in wood," but certainly there is no doubt, as there indicated, of its being the real excavator of the burrows it inhabits. Philippi does not include this species in either of his volumes on the Mollusca of the Two Sicilies; but it appears in the very lately published 'Index Molluscorum Scandinaviæ' of Lovén:—this author refers only to Turton and Deshayes for it: he notices it simply as found in Norway.

This species differs from *Teredo navalis*, Turt., by boring *against* the grain of the wood (all of which is pine), in a diagonal manner.

Within a few square inches of this wood, the perforations of both these species may be seen: they labour harmoniously together in the work of destruction, the one destroying the timber by boring it in a longitudinal direction, the other by its operations being directed against the grain. They both work *within* the outer surface of the wood, but this again is destroyed from *without* inwards by the *Limnoria* and *Chelura*. Many of the chambers of the *Xylophaga* before me are $1\frac{1}{2}$ inch in length, thus exceeding by one half the longest noticed by Turton. The shells of my largest specimens are $5\frac{1}{2}$ lines in length: the two valves joined at the hinge occupy a space of $5\frac{1}{2}$ lines in diameter.

Specimens obtained in rotten timber in 1828 at Ringsend, Dublin bay, by W. H. Harvey, Esq., have been given to me by that gentleman, and when in Dublin in March last I saw in Mr. Warren's collection a piece of wood (sound) filled with the perforations and valves of this species, of which latter I was kindly permitted to take specimens. The wood was found by Mr. Warren on the Dublin coast, where I have little doubt that the species is committing some injury, although such may not yet have been noticed.

Chelura terebrans, Philippi*.

All that has been published on this species has already appeared in the 'Annals;' Philippi's paper, in which it was first described, having been translated and republished in the fourth volume; and Professor Allman's, introducing it as an inhabitant of the British seas, having a place in the Number for the month

* Professor Allman points out certain trivial differences between the specimens described by Philippi and those from Dublin bay. The latter are similar to those from Ardrossan, except in size.

of June last*. I have therefore only to offer a few remarks bearing on the species as found at Ardrossan.

Limnoria and *Chelura* are both present in a piece of wood from Kingstown pier, Dublin bay, given me in 1842 by Mr. R. Ball, as well as in the wood from Ardrossan.

Both species bore in the direction of the grain of the wood, and their cells are quite alike in character: I perceive no mark of distinction when the animals are of equal breadth. The first piece of wood pierced by the *Chelura* which I had an opportunity of examining—that from Kingstown—contained the excavations of large adult individuals. The borings of these were so considerably larger than those of the *Limnoria* which had come under my notice, as to lead me to believe that the difference in the size of the aperture would at once distinguish the working of either species. The piece of wood from Ardrossan, however, not only proved that this was no criterion, but—from the circumstance of the *Chelura* being small, and less in breadth than the *Limnoria*—that theirs were rather the smaller cells.

Both the Crustaceans, like the *Teredo* and *Xylophaga*, labour harmoniously together in the work of destruction, and are mingled in the wood as if they were all of one species.

They can be readily distinguished from each other either when alive or dead, the *Chelura* being of a reddish, the *Limnoria* of a pale grayish yellow hue resembling that of light-coloured pine or fir. As they retain their colours after death, we may even years afterwards distinguish the two species in the excavations which they had formed in timber subjected to their ravages. From this circumstance, added to that of their burrows being formed in the closest contiguity, and many of the creatures dying in them after the timber has been removed from the sea, we may in our museums display whole catacombs of them as closely packed as ever were mummies in the best-tenanted tombs of Egypt. And the Crustaceans have this advantage, that

“Each in his narrow cell for ever laid”

remains perfect as in life, without the aid of any preservative.

On first learning from my friend Professor Allman that the two species were found associated together, I re-examined—for the purpose of ascertaining whether the *Chelura* might not have

* The species (regarding Philippi's as not distinct) was however known to and named by Dr. Leach. British specimens (but from what locality is unknown) belonging to his collection are in the British Museum, and are labelled *Nemertes nesæoides*, Leach. Under this name they appear in the very carefully and elaborately compiled “List of the specimens of Crustacea in the collection of the British Museum” published this year, the work of Mr. Adam White. The name is I believe unpublished; at any rate, both *Nemertes* and *Chelura* are preoccupied as generic terms.

been overlooked—all the wood that I had preserved on account of *Limnoria* borings, but in none of it was the former species to be detected. This wood was all pine, and from Portpatrick, Donaghadee, and Belfast bay: from the first-named places obtained in 1834, and from the last in the present year. In the more marine parts of this bay I was not surprised to find that the *Limnoria* existed. I had however hoped, that where the admixture of fresh with sea-water (if such take place) should be very great even at full-tide, and where at low-water the former only prevails, wood-work would be free from its attacks, but such I regret to state is not the case. For the purpose of testing this, I requested my friend Edmund Getty, Esq.—who is officially connected with the harbour—to have all the beacons or “perches” marking the channel of the river (which they do for about two miles at the upper part of the estuary) examined, and if they proved to be injured, to favour me with specimens of the damaged wood. All this he kindly had done in the month of May last, when the beacons proved to have been all attacked, and those most under the influence of the fresh-water to have suffered equally with those nearest to the open sea. The ship-carpenter who cut the damaged portions off that were sent me, stated to my friend that some old mooring-buoys so high up as the Old Long Bridge were found on removal injured in the same manner. The *Limnoria* was the only borer of any kind found in the beacons alluded to.

It must be mentioned, that judging from the superior size of the *Chelura* borings to those of the *Limnoria* in Dublin bay, I had from that circumstance noted down the perforations in pieces of oak and black birch washed ashore at Belfast as the work of the *Limnoria*; but perceiving, on examination of the wood from Ardrossan, that the borings of the two species may not only be of equal size, but that those of the latter species may be the larger, I was taught that the presence of the Excavator himself must be essential to settle the point, and that circumstantial evidence is insufficient. The wood in question had been so long tossed about in the sea that the animals were all washed out:—both pieces had also been bored by the *Teredo norvegica* (*T. navalis*, Turt.).

In reference to the length of time that the *Chelura* will live after being removed from its native element, the following note was made. A few specimens taken from the sea on Monday morning and received by me in the afternoon of that day were alive on Thursday morning, or seventy-two hours afterwards, when, leaving home for England, I took the piece of wood containing them with me, and on examining it next day found them dead; they had probably lived out of their native element about ninety hours. A number had lived in the same wood for about

sixty-five hours; they were alive on Wednesday night at 12 o'clock and dead on the next morning at 7 o'clock. The wood in which they were, was a small piece about six inches in length and an inch in thickness; it was not wetted since being received on Monday, and was kept in a warm room (about 65° Fahrenheit) all the time. The apparently simple fact of the species thus living so long out of water has a very important bearing, for it suggests to us that this species could, like the *Limnoria*, commit its devastations in wood left dry by the ebbing of every tide. Dr. Coldstream informs us that the latter species "often effects a lodgment in piles very near high-water mark, where it is left dry by the receding tide during the greater part of every twenty-four hours*," and I have very little doubt that the *Chelura* could play a similar part. I have not heard that the extent of the damage done at Ardrossan by the destructive animals noticed in this communication has yet been estimated, but on lately writing to my obliging friend and correspondent there, requesting him to procure if possible perfect specimens of the *Xylophaga* for dissection—the testaceous portions only had before been sent—he replied that the opportunity for so doing was now past, "as the damaged portions of the dock-gates had been replaced by sound timber."

This may not be an inappropriate place to add the following note on *Teredo navalis*.

A copy of Lovén's 'Index Molluscorum Scandinaviæ' lately published, having been kindly sent me by the author, I was induced, in consequence of the *Teredo navalis*, Linn., being there considered distinct from that so called by other authors, to re-examine the shells bearing that name in my cabinet from different parts of the British coasts. The result is that they are all the *T. norvegica*, Spglr. (*T. navalis*, Turt. Brit. Biv.) as distinguished from *T. navalis*, Linn. The localities from which they were obtained are Portpatrick (Scotland) and Donaghadee (co. Down), in both of which the animal was found alive—Miltown Malbay (co. Clare), in drift timber—Belfast, in the bottom of a vessel arrived from the tropics in 1846: *Teredo malleolus*, Turt., was much more numerous in this vessel—Belfast, also in blue clay (subfossil): the valves of these last are very large, being equal in size to those described in my former paper as obtained at Portpatrick. I allude here to specimens procured since that communication was published, a portion of the bough of an oak-tree a few inches in diameter, found during the excavation of a deep sewer, having

* Edin. Phil. Journ. 1834.

been kindly sent me by Edmund Getty, Esq. The wood itself is perfectly sound, but the tree is split and rived in the direction of the grain in some places almost into shreds by the boring powers of the *Teredo*.

XVII.—*On the Pliocene Deposits of the Valley of the Thames at Ilford.* By RICHARD PAYNE COTTON, M.D.

THE tertiary deposits bordering on the Thames appear to be composed of materials of the same general characters, variously arranged, but formed under the same physical circumstances. The formation may be well seen at Brentford, Ilford, Grays and Erith, where beds of gravel will be found resting upon sands of various colours, sandy loam and clays, abounding in remains of mammalia and freshwater shells*. The following description refers to two cuttings in brick-fields at Ilford, one on the north of the London road, belonging to Mr. Curtis, another on the south of the same road, and the west of the Barking lane, the property of Mr. Kilverton. In the former we observe—

	feet.
Vegetable soil with gravel	2
Coarse gravel	2
Coarse yellow sand, stratified	4
Brick earth of various shades of brown, regularly stratified with nodules of carbonate of lime (race) and a few bones	5
Light brown brick earth, interstratified with layers of sand, and full of bones	3
Thin veins of fine sand of shades of yellow and brown irregularly waved	2
Coarse gravel and sand. }	—
	18

In the latter the arrangement is as follows:—

	feet.
Vegetable soil with gravel	2
Coarse gravel and sand stratified	3
Brick earth of shades of brown, stratified	6
Brick earth of a light brown with wavy veins of sand, calcareous nodules (race) and bones	2
Layers of brown and yellow sand, waved, containing in its upper part an abundance of bones	4
Fine yellow and white sand, with freshwater shells	2
Coarse gravel with water. }	—
	19

The stratification of the clays is generally regular and horizontal, the layers however frequently thin out or expand, but the veins of sand are irregular and waved, so that the surface of the cutting, from the changing thickness of the strata, varies extremely

* A list of the shells occurring in these mammaliferous deposits has been given by Mr. J. Morris in the 'Magazine of Natural History,' vol. ii. p. 544.—Ed.